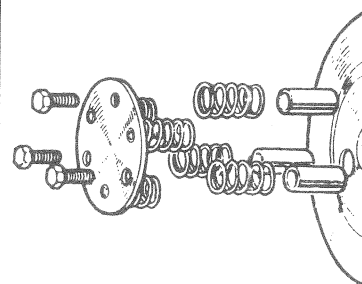


REBUILDING THE CLUTCH

1



RARELY FITTED

Don Morley completed the rebuild of the gearbox last month. Now he moves on to sorting out his Royal Enfield's clutch.

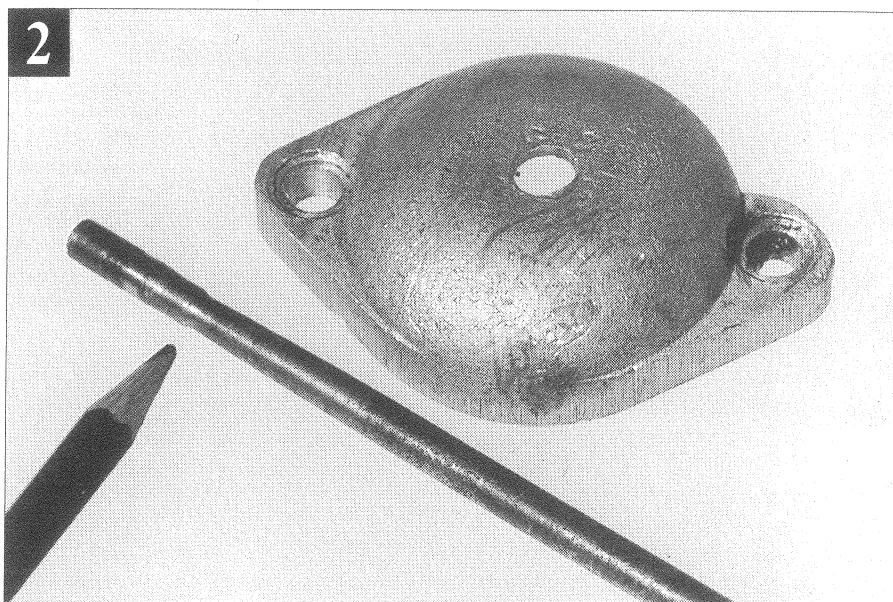
WE left things last month with the main gearbox rebuilt. The outer cover and various ancillaries (gear lever, kick start, neutral selector assembly) were still to go on. But before doing that, one highly recommended modification should be made to vastly improve the clutch action.

Most Albion transmission problems stem from the clutch rather than from the over-engineered gearbox. Glitches almost always occur due to the clutch steadfastly refusing to lift or clear squarely. This is partly because of Albion's habit of fitting non-adjustable springs, but mainly due to the design's reliance on an over-long single spring steel clutch operating rod which inevitably whips and binds within the gearbox mainshaft.

Royal Enfield's own original workshop manuals illustrate a superior two-piece arrangement for their 500 Bullet and big twins (**picture one**), but don't be deceived, the more common 350 needed it just as much.

Unfortunately, in my experience few of bigger bikes came fitted with the modification, meaning Albion or Royal Enfield saved a few coppers somewhere down the line. To the ultimate detriment of their reputation naturally.

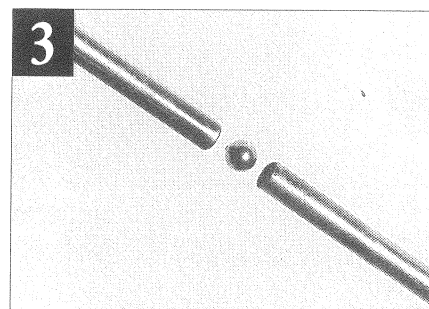
AMC and Norton (Sturmey Archer type) gearboxes used a similar short, hardened, extension and these (although not quite the same rod diameter), can



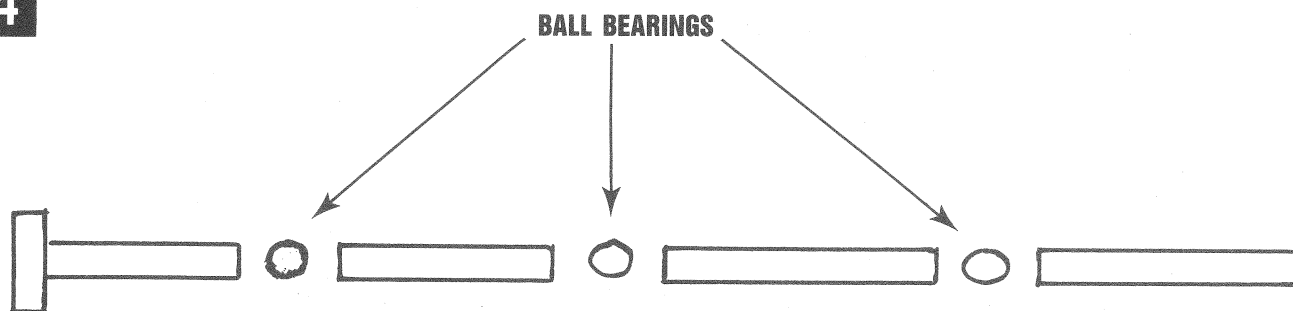
usually be fitted. Like Enfield's genuine item, they are particularly worth using because the larger diameter head pad lifts the clutch appreciably more squarely. For precisely the same reasons, this reduces plate wobble — the other principal cause of clutch drag.

Clutch operating rod

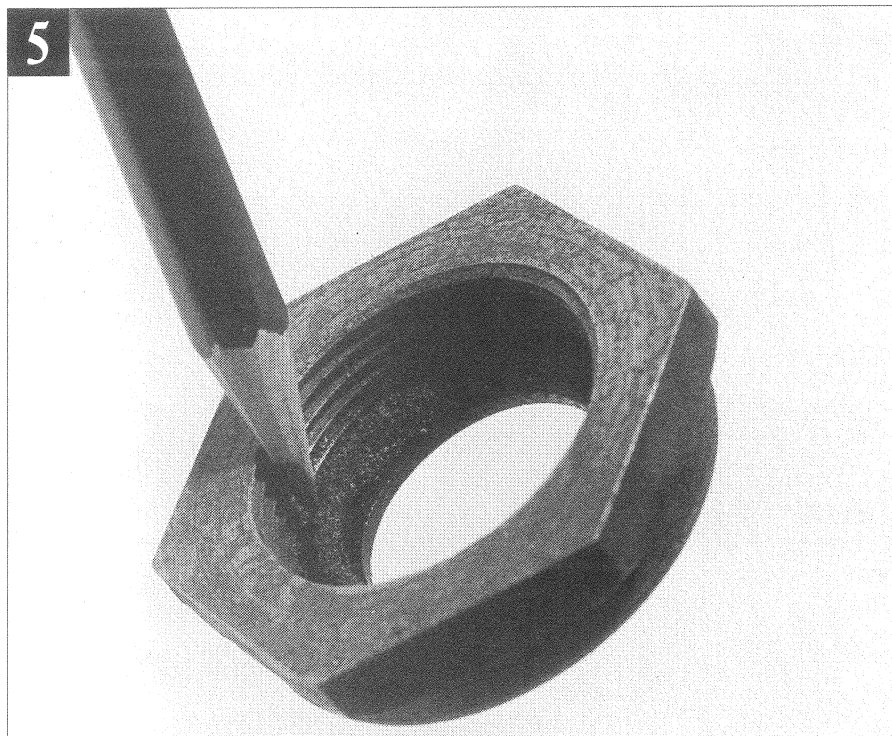
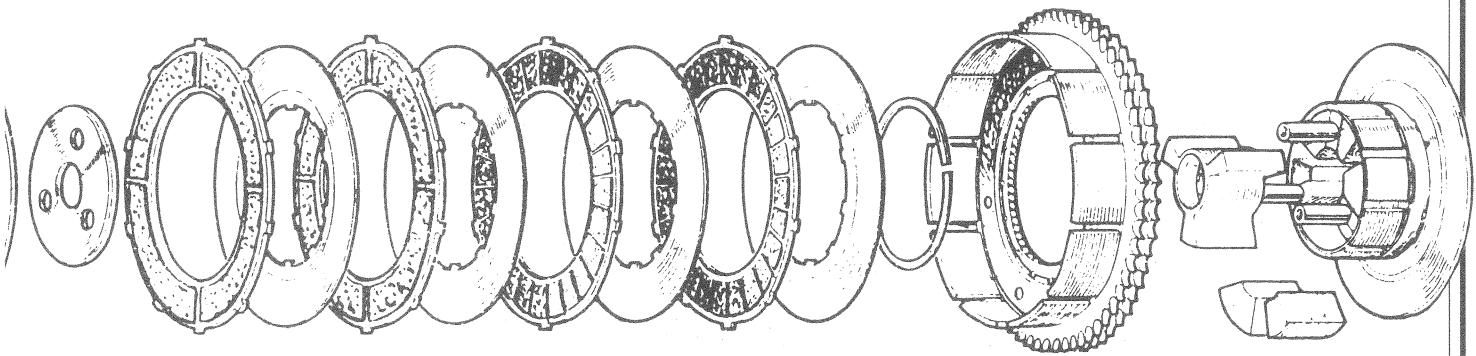
THE addition of this short, double diameter rod has little to do with our



4



NOTE: The balls can be slightly smaller in diameter than the rods, (drawing not scale)



clutch modifications however. If fitted though, it does run according to Enfield's drawing, butting against a separate push rod which is too long. It's this push rod that needs altering to stop it whipping or bowing and causing the loss of vital clutch movement.

- See the wear effect of such bowing in **picture two**.

- An easy cure is to simply cut the push rod into two or three pieces, squarely re-facing the ends, and slipping a suitable diameter ball bearing between the separate pieces — and between the aforementioned Enfield, AMC or Norton larger-head-diameter short push rod.

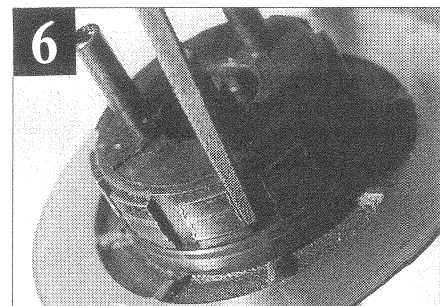
- How well this modification works will instantly be felt on the handlebar after the clutch is fully re-assembled. Despite spring pressure being the same as before, clutch action will no longer be of Arnold Schwarzenegger proportions but sweet and feather light (**picture three**).

- Remember, however, that all clutch

rods are made out of high-grade spring or silver steel, much harder than normal 'mild' steel. In addition, the tips of the rod will have been heat treated to become harder still. By cutting ours into several pieces and adding ball bearings, we have introduced 'soft' ends and unacceptably lengthened the entire assembly (**picture four**).

- Some detail fitting will hence be required and it should be obvious that the cuts ends will need to be precisely squared and trued up. Ideally, this should be done in a lathe but the correct result can be achieved by careful hand filing and rotating the new ends gently against the lead edge of a high speed grindstone.

- Rod ends ultimately need polishing up to mirror finish with emery paper and will have to be re-hardened by heating to bright cherry red before dousing in cold water. I perhaps shouldn't mention this, but before I acquired a blow torch I used to heat the rod ends in the family



gas fire.

- The trick prior to final fitting is to test everything out before hardening the last piece of rod. Do so whilst the gearbox and cover is still off but temporarily fit the clutch assembly to gauge how far the modified rod protrudes beyond the end of our gearbox's mainshaft.

- The key question is, can the gearbox end cover also be loosely fitted, or is the clutch rod protruding too far and holding it away?

- This test will almost certainly reveal that further shortening is required, and with the box end cover still loose, the rod can be pulled out by hand, taking care that the ball between it and the next piece doesn't fall out.

- Then it's just a matter of shaving a bit more metal off to make the push rod the right length — re-shaping and re-hardening the new end, of course.

- But what if you make it too short? Merely add an extra ball bearing to the equation and start again. Indeed, balls don't even seem to mind running together and against each other.

Gearbox end cover

- Once satisfied this is all done we can complete the gearbox end cover's final assembly. First give each of the various rods and balls a really good coating of heavy grease, and similarly the selector mechanism, gearchange and kickstarter parts etc. My own old favourite is Castrol 'Heavy'. Once on it seems to stick like the proverbial to a blanket!

- This is also a good moment to refill

the gearbox with $\frac{3}{4}$ pint of one's preferred lubricant. Again, I favour the all-year-round use of a straight 50 SAE in preference to any multigrade or hypoy type gear oil.

- Next remove the temporarily fitted clutch in readiness for final fitting of the gearbox sprocket. This item should not have hooked or worn teeth — re-fitting an old worn one will only wreck the chain. It is also wise to replace the sprocket holding nuts' felt sealing ring which is often missed, hidden as it is **WITHIN** the inner threaded area (**picture five**).

- This tiny ring is most important, for it is this (and not the gearbox's main seal) which stops oil leaking gradually down the mainshaft and out on to the garage floor — especially when the bike is leaned on its prop stand for long periods.

Clutch assembly

- Now we turn to the clutch and primary transmission's final assembly. For our Enfield gearbox to finish up as sweet in action as an AMC or BSA's it must have a clutch which is running absolutely true — no buckled plates, no unequal length springs, no worn out cush drive rubbers (wherever they are fitted), no ridged operating splines. If any of these existing parts can't be re-trued to work properly, chuck it away and get a new one.

- That's why it is vital to first check the clutch's main body for 'true' in a lathe. Have it resurfaced if need be but bear in mind that any more than a few thou taken off the back plate will upset the primary chain alignment. If more substantial removal is necessary, take it to an expert machinist who will spray some molten metal back on to the plate then have it re-ground back to size.

- Also keep a close eye on the cush drive rubbers as fitted to 500cc Bullet Trials bikes and all of the twins — except the 350cc Roadsters. Oil getting on to these rubbers causes them to soften up and perish, allowing the clutch main body to oscillate, run out of true, and generally flop about.

- The splines on which the clutch plates run or slide will inevitably be deeply burred, hooked or ridged. A laborious job, but each edge will need cutting back to true with a square edged file (**picture six**) and all burrs removed from the matching tongues on the clutch plates (**picture seven**).

- Any clutch metal plates which have been 'blued' by heat should be scrapped, for they will have become buckled. For the reason check every plate for flatness with a steel ruler or straight edge.

- If possible, it is always best to ditch items like clutch plates in favour of new ones, but if old items must be re-used, at least make sure surface glaze is removed from the plates with fine grade emery cloth.

- Assuming the primary chaincase inner and clutch centre have already been re-fitted and the clutch's retaining nut treated to a drop of best Loctite thread bond between it and the gearbox mainshaft, we can almost rush on to finish the job.

Clutch springs

- Enfields normally employed six clutch springs incidentally, but these would originally have been supplied in several various strengths, lengths or tensions to suit the company's various machines. Six of the strongest would be used on the powerful 736cc Interceptor while the humble 350cc Bullet managed with a set of the weakest.

- Enfield/Albions also used a mixture of springs on models with differing power outputs. For instance, the 500cc jobs relied on three strong and three soft springs. Whatever the combination used on your own particular bike, what truly matters is that **ALL** spring sets **MUST** be a precise match to its opposite number diagonally across the clutch's outer spring holder. If the springs don't match in their strength, the clutch will never open squarely.

- Clutch springs are best renewed if in any doubts, but only in complete sets. Even new springs can vary slightly in tension so check each one for length (**picture eight**). In this instance the micrometer is being used merely as a convenient sliding fit gauge rather than to actually measure anything.

- If for some reason the springs (whether in sets of three or six) do not match up, they must shimmed out to achieve the correct length. This will mean selecting washers of suitable diameter and thickness to slip over the

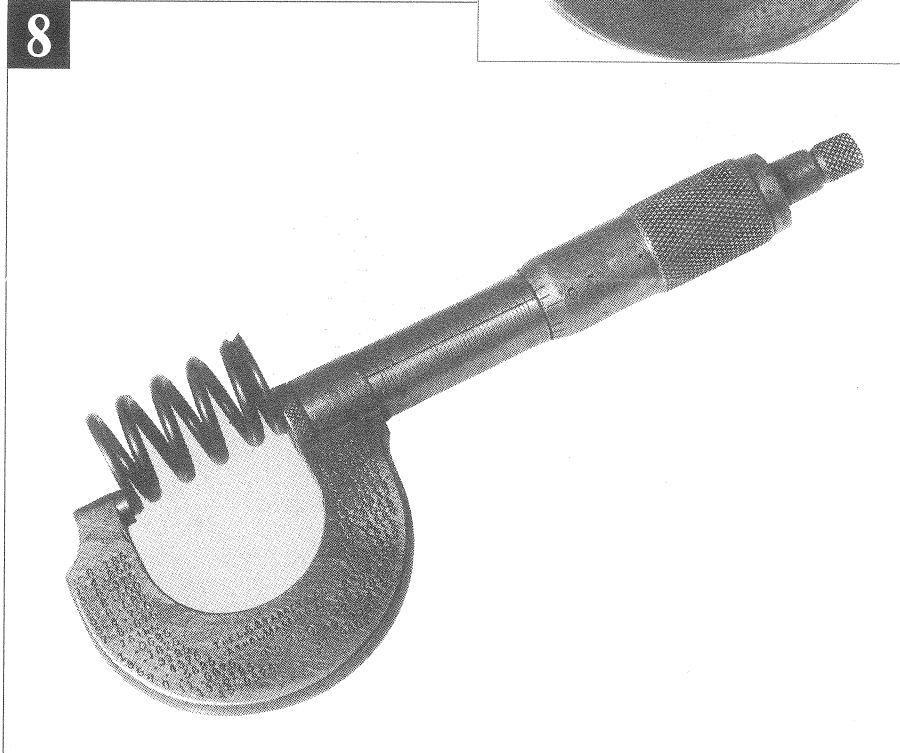
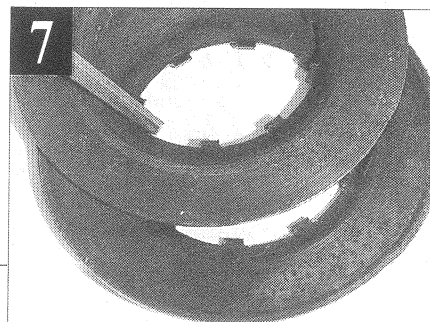
spring posts to lengthen the operation of the spring.

Setting up

- Once the clutch is precisely set up, and the engine sprocket, primary chain and alternator assembly re-fitted we should check the clutch's action both **BEFORE** and after fitting the rear chain and setting the primary chain tensioner. The clutch action will be affected adversely if any of the above are set too tight or too loose. It is also important to feel and test how clean and squarely the clutch lifts when rotated by the kick starter.

- Adjust the primary chain to give a bare minimum of $\frac{1}{4}$ " free play at its tightest point on the top run. Then give the rear chain a minimum of $\frac{1}{2}$ " free play on the **BOTTOM**. Make these vital adjustments with the chains at their loosest — with the bike on its centre stand. (If in any doubt about either of these settings it is always better to err slightly on the loose side.)

- Almost there now as we make sure the clutch's control cable has some free play and is routed with the gentlest bend possible, which in Royal Enfield's instance means not threading it through the paltry little hole provided in the front fork yoke. Likewise, for the lightest possible action it is far better to use a



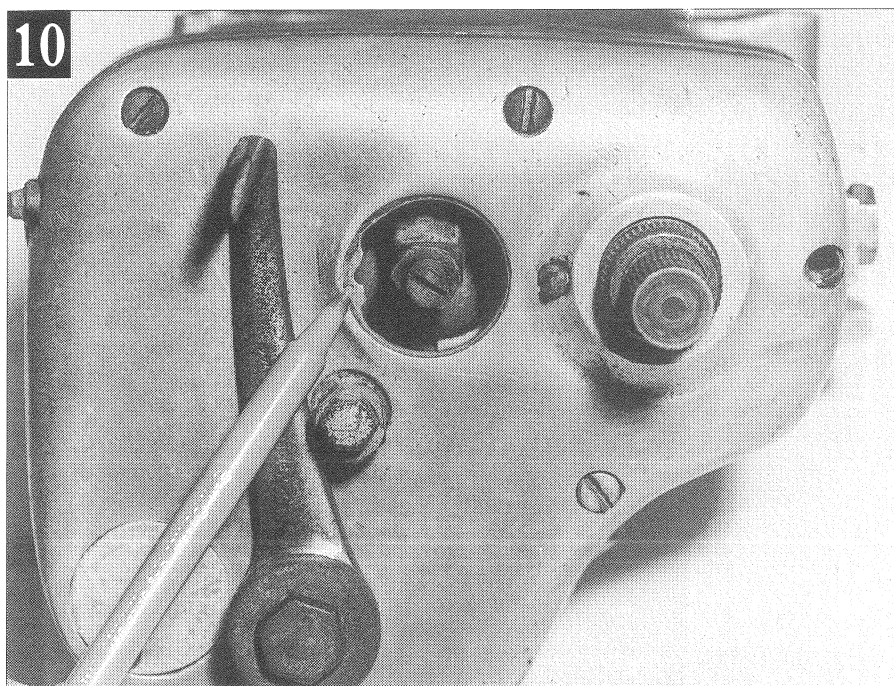
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CABLE ADJUST

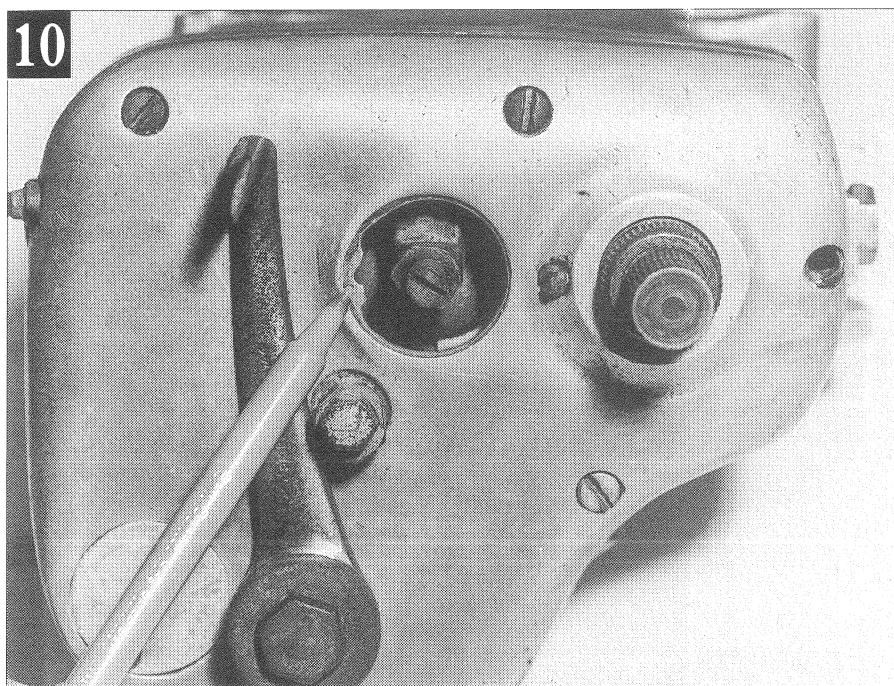
GEARBOX OIL
FILLER HOLE

CLUTCH ADJUSTER

MUST HAVE AT
LEAST 1/32" FREE
PLAY AT THIS
POINT



10



modern style cable with separate nylon outer and inner sheathing.

● Just before re-fitting the outer primary chaincase cover, get the feeler gauges out and double check there is ample and equal air space between the alternator's rotor and the stator. If not, merely slacken the latter's three holding nuts and give the outer core ring a sharp tap or two to re-site it properly. Check the space again when the stator is re-tightened.

● Enfield primary chaincase halves do not need any gasket solution to keep them oil tight PROVIDED they and their rubber sealing ring are all clean and dry on assembly. My own preference for primary transmission lubricant is a very light multigrade or car-type automatic transmission fluid, principally because these lighter oils penetrates best between the clutch plates.

● The gearbox's neutral selector has to be set by slackening the 3/16" Whit

lock bolt and then rotating the eccentric barrel behind it until the selector lever itself hits the barrel when stamped upon at the actual point of the gears dropping into neutral. At this point the locking bolt can be re-tightened.

Clutch adjustment

● The final job prior to road testing is to set the clutch cable adjustments. Firstly, I prefer to temporarily detach the cable at the handlebar end. With the gearbox inspection plates removed, set the internal adjuster so the upper clutch arm (just visible within the top inspection hole, **picture nine**) has approximately 1/32" of free movement but does not angle out sufficiently to risk it touching the inspection cover when it is refitted.

● Attach the clutch cable and take out any surplus via the cable adjuster which can be found adjacent to the main oil filler hole behind the gearbox's inner/outer cover.

● That just about completes the job — but one word of warning. Never over-tighten the lower clutch adjustment inspection cover. If you do, the screws are likely to break the entire fixing/casting off as in **picture 10**.

AND that completes my rebuild of the Albion/Enfield transmission for Classic & Motorcycle Mechanics. I now suspect editor Berry has some other fiendishly complicated task for me. We shall see.